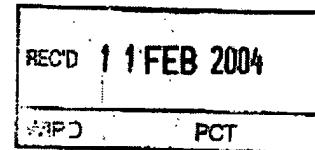


TRANSLATION CERTIFICATION

This is a complete and accurate translation by us, to the best of our knowledge and ability, from German into English, of the priority certification of the submission of patent application WO 2004/057058 A3 / PCT/EP2003/014205

PCT/EP03/14205

FEDERAL REPUBLIC OF GERMANY



PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH
RULE 17.1(a) OR (b)

PRIORITY CERTIFICATION OF THE SUBMISSION OF A PATENT APPLICATION

File Number:	102 59 386.8
Date of Application:	December 19, 2002
Applicant/Assignee:	Gesellschaft für Hochleistungselektrolyseure zur Wasserstofferzeugung mbH, Ottobrunn/DE
Title:	Pressure Electrolyzer and Cell Frame for Said Electrolyzer
IPC:	C 25 B 9/18

The attached items are a true and accurate reproduction of the original documents of this patent application.

Munich, December 1, 2003
German Patent and Trademark Office
The president
per pro.

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Letang

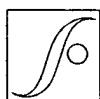
FRANK C. FARNHAM COMPANY, INC.

By: Frank C. Farnham

Name: Frank C. Farnham

Its: General Manager

Date: October 31, 2008



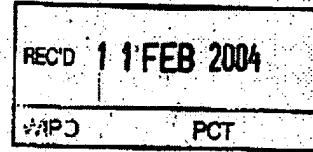
FRANK C. FARNHAM COMPANY, INC.

TRANSLATION (Priority Document for PCT/EP2003/014205):

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December 18, 2002

A B S T R A C T

The invention describes a pressure electrolyzer and a cell frame for said electrolyzer.

The pressure electrolyzer (1) comprises a pressure tank (2) and an electrolytic cell block (3), which is located in the pressure tank (3) and contains a number of electrolytic cells (4) combined in the form of a stack, wherein each electrolytic cell (4) contains an anode (11) and a cathode (12), and wherein the electrolytic cell block (3) has a sealed housing (5). The invention is characterized by the fact that the housing (5) of the electrolytic cell block (3) is formed by a number of stacked cell frames (15, 16; 25, 26) of the electrolytic cells (4); that the cell frames (15, 16; 25, 26) consist at least partially of a material (15a, 16a; 25a, 26a) that is elastic at least in the longitudinal direction of the electrolytic cell block (3) and seals adjacent cell frames (15, 16; 25, 26) from each other; and that the electrolytic cell block (3) is held in place between end plates (21, 22) under compression of the elastic material (15a, 16a; 25a, 26a).

December 18, 2002

**PRESSURE ELECTROLYZER AND CELL FRAME
FOR SAID ELECTROLYZER**

The invention concerns a pressure electrolyzer in accordance with the introductory clause of Claim 1 and a cell frame for said electrolyzer in accordance with the introductory clause of Claim 11.

Pressure electrolyzers for the electrolytic cleavage of water into hydrogen and oxygen are known which have a pressure tank and a block of electrolytic cells, which is arranged in the pressure tank and contains a number of electrolytic cells combined in the form of a stack. Each electrolytic cell contains an anode and a cathode. An electrolytic fluid or electrolyte circulation system serves to supply an anolyte to the anodes and a catholyte to the cathodes. The electrolytic cell block has a sealed housing, by which it is sealed from the interior of the pressure tank. A pressure electrolyzer of this type is described in DE 25 48 699 C3.

Expensive devices that contain spring elements, a support frame, and similar components are usually necessary for tensioning and sealing the individual cells of the electrolytic cell block against one another. The power supply system for the electrolytic cell block has previously consisted of a large number of parts, including a pressure pipe, gaskets, etc.

The objective of the invention is to create an improved pressure electrolyzer, specifically, a pressure electrolyzer that has a simpler design and is constructed with a smaller number of parts and can thus be manufactured at low cost. A further objective is the creation of a cell frame for the construction of the electrolytic cell block.

These objective are achieved, on the one hand, by a pressure electrolyzer with the features of Claim 1 and, on the other hand, by a cell frame for a pressure electrolyzer with the features of Claim 11.

Advantageous modifications are specified in the dependent claims.

The invention creates a pressure electrolyzer with an electrolytic cell block that contains a number of electrolytic cells combined in the form of a stack. Each electrolytic cell contains an anode and a cathode. The electrolytic cell block has a sealed housing. End plates are mounted at the ends of the electrolytic cell block. In accordance with the invention, the housing of the electrolytic cell block is formed by a number of stacked cell frames. The cell frames consist at least partially of a material that is elastic at least in the longitudinal direction and the transverse direction of the electrolytic cell block and seals adjacent cell frames from each other. The electrolytic cell block is held in place between the end plates under compression of the elastic material in the longitudinal direction. An advantage of the pressure electrolyzer of the invention is that thermal expansion of the individual electrolytic cells and thus of the entire electrolytic cell block is compensated by the elastic material provided in the cell frames. On the one hand, this makes it possible to provide the end plates in stationary form in a simplified way, for example, in the form of tank covers of a pressure tank surrounding the electrolytic cell block. On the other hand, additional devices for keeping the electrolytic cell block under a well-defined pretension in all temperature ranges can be dispensed with. In addition, relatively large manufacturing tolerances of the electrolytic cells and the cell frames can be compensated by the elastic material.

Preferably, the cell frames can have a rigid element, which runs in the circumferential direction of the frame for mechanical stabilization of the cell frames and is connected with the elastic material.

In accordance with one embodiment of the invention, the rigid element can form a shell-like frame structure, which partially encloses the elastic material and from which the elastic material partially protrudes to form a compressible region in the longitudinal direction of the electrolytic cell block.

In accordance with another embodiment of the invention, the rigid element can form a frame-like insert that is wholly or partially embedded in the elastic material.

In accordance with a modification of the invention, adjacent cell frames can each have projecting parts and recesses that fit into each other for locking the adjacent cell frames in place and/or for sealing the adjacent cell frames.

In accordance with a preferred embodiment of the invention, each anode can have its own anode cell frame, and each cathode can have its own cathode cell frame.

The elastic material can consist of an elastomer or a soft elastic thermoplastic.

The rigid element can consist of a dimensionally stable material, especially a metal or a plastic.

The rigid element that forms the shell-like frame structure can consist of an electrically insulating material, especially plastic.

In addition, the invention creates a cell frame for a pressure electrolyzer with the aforementioned features.

Specific embodiments of the invention are explained below with reference to the drawings.

-- Figure 1 shows a schematic cutaway top view of a pressure electrolyzer in accordance with one embodiment of the invention.

-- Figure 2 shows an enlarged cutaway view of a portion of the cell frames of the

electrolytic cells, which simultaneously form a sealed housing of the electrolytic cell block in accordance with one embodiment of the invention.

-- Figure 3 shows a cutaway view, similar to Figure 3, of another embodiment of the invention.

-- Figure 4 shows a detail view of a cell frame in accordance with another embodiment of the invention.

Figure 1 shows a pressure electrolyzer, which is labeled as a whole by reference number 1, and in which an electrolytic cell block 3 is mounted in a pressure tank 2. The electrolytic cell block 3 consists of a number of electrolytic cells 4 arranged in a stack. Each electrolytic cell comprises an anode 11 and a cathode 12, which are separated from each other by a diaphragm 13 arranged between them. Between two adjacent electrolytic cells 4, there is a bipolar separator 14, by which the anode compartment of one electrolytic cell 4 is separated from the cathode compartment of the adjacent electrolytic cell 4, while at the same time electrical contact between the two is maintained. End plates 21, 22 are provided at the ends of the electrolytic cell block 3, namely, an end plate 21 at the anode end and an end plate 22 at the cathode end. The end plates 21, 22 hold the electrolytic cell block 3 in its longitudinal direction under mechanical pretensioning with the individual electrolytic cells 4 sealed from one another. In addition, the end plates 21, 22 form the terminal seal of the pressure tank 2. Finally, the end plates 21, 22 serve to supply electric power to the electrolytic cell block 3. The power is supplied through a power supply line 23 at the anode end and a power supply line 24 at the cathode end. Electrical insulation 31, 32, 33 is arranged on the end plates 21, 22 and on the inside of the pressure tank 2. The housing 5 of the electrolytic cell block 3 is formed by a number of stacked cell frames 15, 16; 25, 26 of the electrolytic cells 4. In the embodiment shown in Figure 1, each anode 11 is

provided with its own adjacent anode cell frame 15; 25, and each cathode 12 is provided with its own adjacent cathode cell frame 16.

As is shown in Figures 2 and 3, which represent two different embodiments of the cell frames 15, 16 and 25, 26, respectively, the cell frames 15, 16; 25, 26 consist at least partially of an elastic material 15a, 16a and 25a, 26a, respectively, which is elastic at least in the longitudinal direction and the transverse direction of the electrolytic cell block 3. This elastic material 15a, 16a and 25a, 26a, respectively, seals adjacent cell frames 15, 16 and 25, 26, respectively, from each other, and the elastic material 15a, 16a and 25a, 26a, respectively, is compressed in the longitudinal direction, which causes the electrolytic cell block 3 to be held in place between the end plates 21, 22, as Figure 1 shows. Besides sealing adjacent cell frames 15, 16 and 25, 26, respectively, from each other, the compressibility of the elastic material 15a, 16a and 25a, 26a, respectively, compensates thermal expansion or contraction during the startup, operation and shutdown of the pressure electrolyzer and also compensates dimensional tolerances of the individual cell frames 15, 16 and 25, 26, respectively. The cell frames 15, 16 and 25, 26, respectively, additionally comprise a rigid element 15b, 16b and 25b, 26b, respectively, which runs in the circumferential direction of the frame, mechanically stabilizes the cell frames 15, 16 and 25, 26, respectively, and is connected with the elastic material 15a, 16a and 25a, 26a, respectively.

In the embodiment illustrated in Figure 2, the rigid element 15b, 16b forms a shell-like frame structure, which partially encloses the elastic material 15a, 16a and from which the elastic material 15a, 16a partially protrudes to form a compressible region 15c, 16c in the longitudinal direction of the electrolytic cell block 3. The elastic material 15a, 16a can thus be placed under compression between the rigid element 15b, 16b in which it is embedded and the rigid element

15b, 16b of the adjacent cell frame 15, 16, so that it can carry out the aforementioned functions of sealing adjacent cell frames 15, 16 and compensating thermal expansion.

In the embodiment illustrated in Figure 3, the rigid element 25b, 26b forms a frame-like insert that is embedded in the elastic material 25a, 26a of the respective cell frame 25 and 26.

As Figure 2 shows, the adjacent cell frames 15, 16 have projecting parts 15d, 16d and recesses 15e, 16e that fit into each other and serve to lock the adjacent cell frames 15, 16 in place and/or seal the adjacent cell frames 15, 16. For example, cell frame 15, specifically, its shell-like rigid element 15b, has a projection 15d, which fits into a recess 16e of the adjacent cell frame 16, specifically, a recess 16e in the elastic material 16a of the adjacent cell frame 16. Similarly, cell frame 16, specifically, its shell-like rigid element 16b, has a projection 16d, which fits into a recess 15e of the following adjacent cell frame 15, specifically, a recess 15e in the elastic material 15a of the adjacent cell frame 15.

In both of the embodiments shown in Figures 2 and 3, each anode 11 is assigned its own anode cell frame 15 and 25, respectively, and each cathode 12 is assigned its own cathode cell frame 16 and 26, respectively.

In the embodiment shown in Figure 2, peripheral slits 111, 112, which receive the anode 11 and the cathode 12, respectively, are formed in the elastic material 16a of cell frame 16, which in the present case is referred to as the cathode cell frame. A peripheral slit 114, which receives the bipolar separator 14, is formed in the elastic material 15a of cell frame 15, which in the present case is referred to as the anode cell frame. Although the slits 111, 112 are thus provided for both the anode 11 and the cathode 12 in the elastic material 16a of the cathode cell frame 16, cell frame 15 should be regarded as assigned to the anode, and cell frame 16 should be regarded as assigned to the cathode, which is repeated for each electrolytic cell 4. The peripheral

slits 111, 112, 114 in the elastic material 15a and 16a allow dimensionally stable, tight and positionally stable holding of the anode 11, cathode 12 and bipolar collector 14 without any additional measures. This also applies to a diaphragm contained in the electrolytic cells. For the sake of simplicity, however, the diaphragm is not shown in Figure 2.

In the embodiment shown in Figure 3, peripheral slits 211 and 213, which receive the anode 11 and the diaphragm 13, respectively, are again formed in the elastic material 25a of cell frame 25, which is referred to here as the anode cell frame. In contrast to Figure 2, in Figure 3 the diaphragm 13 is explicitly shown. In addition, a peripheral recess 212, which receives the cathode 12, is formed on the side of the elastic material 25a that faces the elastic material 26a of the adjacent cell frame 26a. The elastic material 26a of the adjacent cell frame 26, which is referred to here as the cathode cell frame, contains a recess 214 for receiving the bipolar separator 14 on its side facing the cell frame 25 of the following electrolytic cell 4. Here again, the anode 11 and the cathode 12 each has its own cell frame, namely, anode cell frame 25 and cathode cell frame 26, which is repeated for each electrolytic cell. The peripheral slits 211, 213 and the peripheral recesses 212, 214 allow the respective elements, namely the anode 11, the diaphragm 13, the cathode 12 and the bipolar separator 14, to be held in the cell frames 25, 26 in a dimensionally stable, tight and positionally stable way, so that no additional measures are required for this.

The elastic materials 15a, 16a and 25a, 26a of the respective cell frames 15, 16 and 25, 26 can consist of an elastomer or a soft elastic thermoplastic.

The rigid elements 15b, 16b and 25b, 26b of the respective cell frames 15, 16 and 25, 26 can consist of a dimensionally stable material, especially a metal, another suitable metal, or a plastic.

In the embodiment shown in Figure 2, the rigid element 15b, 16b that forms the shell-like frame structure consists especially of an electrically insulating material, especially plastic.

The surfaces of the components of the cell frames 15, 16 and 25, 26 that are continually acted upon by the gas-containing media present in the pressure electrolyzer 1 can be sheathed in a suitable coating, e.g., PTFE, as additional protection and as a means of reducing flammability.

The shape of the cell frames 15, 16 and 25, 26 can be adapted to the interior of the pressure tank 2 in such a way that they not only fulfill their function of forming the housing 5 of the electrolytic cell block 3 but also serve as a support structure for the electrolytic cell block 3.

As Figure 4 shows, flow obstacles 300 formed by serrations 310 can be provided on the upper surface of the upper frame pieces of the cell frames 15, 16 and 25, 26 to improve the gas separation effect.

List of Reference Numbers

- 1 pressure electrolyzer
- 2 pressure tank
- 3 electrolytic cell block
- 4 electrolytic cells
- 5 housing
- 11 anode
- 12 cathode
- 13 diaphragm
- 14 bipolar separator
- 15; 25 anode cell frame
- 15a; 25a elastic material
- 15b; 25b rigid element
- 15c compressible region
- 15d projection
- 15e recess
- 16; 26 cathode cell frame
- 16a; 26a elastic material
- 16b; 26b rigid element
- 16c compressible region
- 16d projection
- 16e recess
- 21, 22 end plate

23, 24	power supply line
31	electrical insulation
32	electrical insulation
33	electrical insulation
111	slit
112	slit
114	slit
211	slit
212	recess
213	slit
214	recess
300	flow obstacle
310	serration

C L A I M S

1. Pressure electrolyzer with an electrolytic cell block (3) that contains a number of electrolytic cells (4) combined in the form of a stack, wherein each electrolytic cell (4) contains an anode (11) and a cathode (12), and wherein the electrolytic cell block (3) has a sealed housing (5), characterized by the fact that the housing (5) of the electrolytic cell block (3) is formed by a number of stacked cell frames (15, 16; 25, 26) of the electrolytic cells (4); that the cell frames (15, 16; 25, 26) consist at least partially of a material (15a, 16a; 25a, 26a) that is elastic at least in the longitudinal direction of the electrolytic cell block (3) and seals adjacent cell frames (15, 16; 25, 26) from each other; and that the electrolytic cell block (3) is held in place between the end plates (21, 22) under compression of the elastic material (15a, 16a; 25a, 26a).

2. Pressure electrolyzer in accordance with Claim 1, characterized by the fact that the cell frames (15, 16; 25, 26) have a rigid element (15b, 16b; 25b, 26b), which runs in the circumferential direction of the frame for mechanical stabilization of the cell frames (15, 16; 25, 26) and is connected with the elastic material (15a, 16a; 25a, 26a).

3. Pressure electrolyzer in accordance with Claim 2, characterized by the fact that the rigid element (15b, 16b) forms a shell-like frame structure, which partially encloses the elastic material (15a, 16a) and from which the elastic material (15a, 16a) partially protrudes to form a compressible region (15c, 16c) in the longitudinal direction of the electrolytic cell block (3).

4. Pressure electrolyzer in accordance with Claim 2, characterized by the fact that the rigid element (25b, 26b) forms a frame-like insert that is wholly or partially embedded in the elastic material (25a, 26a).

5. Pressure electrolyzer in accordance with Claim 3 or Claim 4, characterized by the fact that adjacent cell frames (15, 16; 25, 26) each have projecting parts (15d, 16d) and recesses (15e,

16e) that fit into each other for locking the adjacent cell frames (15, 16; 25, 26) in place and/or for sealing the adjacent cell frames (15, 16; 25, 26).

6. Pressure electrolyzer in accordance with any of Claims 1 to 5, characterized by the fact that each anode (11) has its own anode cell frame (15; 25), and each cathode (12) has its own cathode cell frame (16; 26).

7. Pressure electrolyzer in accordance with any of Claims 1 to 6, characterized by the fact that the elastic material (15a, 16a; 25a, 26a) consists of an elastomer or a soft elastic thermoplastic.

8. Pressure electrolyzer in accordance with any of Claims 2 to 7, characterized by the fact that the rigid element (15b, 16b; 25b, 26b) consists of a dimensionally stable material, especially a metal or a plastic.

9. Pressure electrolyzer in accordance with any of Claims 3 to 8, characterized by the fact that the rigid element (15b, 16b) that forms the shell-like frame structure consists of an electrically insulating material, especially plastic.

10. Pressure electrolyzer in accordance with any of Claims 1 to 9, characterized by the fact that the end plates (21, 22) form the power supply to the ends of the electrolytic cell block (3).

11. Cell frame for a pressure electrolyzer, which comprises an electrolytic cell block (3) that contains a number of electrolytic cells (4) combined in the form of a stack, wherein each electrolytic cell (4) contains an anode (11) and a cathode (12), and wherein the electrolytic cell block (3) has a sealed housing (5), characterized by the fact that the housing (5) of the electrolytic cell block (3) is formed by a number of stacked cell frames (15, 16; 25, 26) and that the cell frame (15, 16; 25, 26) consists at least partially of a material (15a, 16a; 25a, 26a) that is

elastic at least in the longitudinal direction of the electrolytic cell block (3) and seals adjacent cell frames (15, 16; 25, 26) from each other.

12. Cell frame in accordance with Claim 11, characterized by the fact that the cell frame (15, 16) has a rigid element (15b, 16b; 25b, 26b), which runs in the circumferential direction of the frame for mechanical stabilization of the cell frame (15, 16; 25, 26) and is connected with the elastic material (15a, 16a; 25a, 26a).

13. Cell frame in accordance with Claim 12, characterized by the fact that the rigid element (15b, 16b) forms a shell-like frame structure, which partially encloses the elastic material (15a, 16a) and from which the elastic material (15a, 16a) partially protrudes to form a compressible region (15c, 16c) in the longitudinal direction of the electrolytic cell block (3).

14. Cell frame in accordance with Claim 12, characterized by the fact that the rigid element (25b, 26b) forms a frame-like insert that is wholly or partially embedded in the elastic material (25a, 26a).

15. Cell frame in accordance with Claim 13 or Claim 14, characterized by the fact that each cell frame (15, 16; 25, 26) has projecting parts (15d, 16d) and recesses (15e, 16e) that fit into each other for locking adjacent cell frames (15, 16; 25, 26) in place and/or for sealing adjacent cell frames (15, 16; 25, 26).

16. Cell frame in accordance with any of Claims 11 to 15, characterized by the fact that each anode (11) has its own anode cell frame (15; 25), and each cathode (12) has its own cathode cell frame (16; 26).

17. Cell frame in accordance with any of Claims 11 to 16, characterized by the fact that the elastic material (15a, 16a; 25a, 26a) consists of an elastomer or a soft elastic thermoplastic.

18. Cell frame in accordance with any of Claims 12 to 17, characterized by the fact that

the rigid element (15b, 16b; 25b, 26b) consists of a dimensionally stable material, especially a metal or a plastic.

19. Cell frame in accordance with any of Claims 13 to 18, characterized by the fact that the rigid element (15b, 16b) that forms the shell-like frame structure consists of an electrically insulating material, especially plastic.

LIST OF TRANSLATOR'S COMMENTS AND CORRECTIONS

Page 6, Lines 8-9. " electrolytic cell block 3 " This is not labeled in any of the drawings

Page 7, Lines 1-2. " and each cathode 12 is provided with its own adjacent cathode cell frame 16." WO 2004/057,058 (A3) has the corrected version, i.e., 16, 26. The priority DE application (the present document) is incorrect. It should read " and each cathode 12 is provided with its own adjacent cathode cell frame 16, 26."

Page 9, Lines 22-23. " especially a metal, another suitable metal, or a plastic." Since they haven't mentioned a first suitable metal, we have no idea what they mean by "another suitable metal". Probably, they intended to write something like " especially a metal, such as aluminum or some other suitable metal, or a plastic".

Page 13, Claim 1, Lines 8-9. " and that the electrolytic cell block (3) is held in place between end plates (21, 22) under compression of the elastic material (15a, 16a; 25a, 26a)." In the priority application "den" appears, but not in the original WO application; " between the end plates (21, 22) "